REMARKS

Claims 1-27 were pending. Dependent claims 28-29 are hereby added, and no new matter is believed to have been added thereby. Claims 1-29 are now pending.

In the Office Action, the Examiner again rejected claims 1, 3, 5, 11, 14-16, 18, 24, and 26 pursuant to 35 U.S.C. §102(e) as anticipated by Halmann, et al. (US 6,526,163). Claim 2 was rejected pursuant to 35 U.S.C. §103(a) as unpatentable over Halmann, et al. in view of Zar (A Scan Conversion Engine . . .). Claims 4 and 17 were rejected pursuant to 35 U.S.C. §103(a) as unpatentable over Halmann, et al. in view of Hossack, et al. (US 6,352,511). Claims 6 and 19 were rejected pursuant to 35 U.S.C. §103(a) as unpatentable over Halmann, et al. in view of Okerlund, et al. (US 6,690,371). Claims 7 and 20 were rejected pursuant to 35 U.S.C. §103(a) as unpatentable over Halmann, et al. in view of Drebin, et al. (US 4,835,712). Claims 9 and 22 were rejected pursuant to 35 U.S.C. §103(a) as unpatentable over Halmann, et al. in view of Swerdloff (US 5,483,567). Claims 12, 13, and 25 were rejected pursuant to 35 U.S.C. §103(a) as unpatentable over Halmann, et al. Claim 27 was rejected pursuant to 35 U.S.C. §103(a) as unpatentable over Halmann, et al. in view of Edic, et al. (US 2004/0136490).

Claims 8, 10, 21, and 23 were objected to as being allowable if amended into independent form.

Applicants respectfully request reconsideration of the rejections of claims 1-7, 9, 11-20, 22, and 24-27, including independent claims 1 and 14. *New arguments are provided below in italics.*

Independent claim 1 recites a processor operable to identify acquired ultrasound data as a function of the values where a look-up table has the values corresponding to a spatial conversion from the display format to the acquisition format.

Halmann, et al. do not disclose this limitation. Halmann, et al. note that a CPU generates the scan converter tables necessary to convert scanned data from the polar coordinate system to the Cartesian coordinate system where the tables are dependent on the mode of operation (col. 7, lines 54-59). Scan conversion is performed with interpolation and the like (col. 8, line 53-col. 9, line 4). Halmann, et al. do not provide further details for the tables, but indicate that the tables convert the data. Halmann, et al. do not use values of the table to identify ultrasound data where the display values are interpolated from the identified ultrasound

data. There is no teaching that acquired ultrasound data is identified as a function of the values of the look-up table.

Claim 1 recites the table having values corresponding to a spatial conversion from the display format to the acquisition format. Halmann, et al. convert polar coordinates into Cartesian coordinates (col 7, lines 55-57; and col 8, lines 64-65), not a look-up table used for the conversion of Cartesian coordinates to the polar coordinates.

In reply, the Examiner cites to the creation and use of scan conversion tables (col. 7, lines 54-57; and col. 8, line 53-col. 9, line 4). The Examiner alleges that, since the scan conversion is converting the polar scanned data to display values, it is identifying the polar data as a function of the Cartesian values, and alleges that the look-up table is reversible.

However, Halmann, et al. do not disclose the structure of the lookup table. The lookup table, to be used for scan conversion, likely has interpolation values given an input Polar coordinate. The interpolation values are then applied to the data for that Polar coordinate to weight the data and create Cartesian data. The table is likely for interpolation values for the actual conversion of data at particular coordinates, so would not have a Cartesian coordinate output given a polar coordinate input. The table would not be reversible as alleged by the Examiner. Halmann, et al. do not use values of the table to identify ultrasound data where the display values are interpolated from the identified ultrasound data. There is no teaching that acquired ultrasound data is identified as a function of the values of the look-up table.

Even if reversible, Halman, et al. convert polar coordinate data to Cartesian coordinate data. There is no reason to identify polar coordinate data from or starting with a Cartesian coordinate. The process flows by providing polar coordinate data. The polar coordinate data is then interpolated (weighted and summed) to represent data at a Cartesian coordinate. The location of the Cartesian coordinate does not need to be known before hand. The available polar coordinate data is converted. An inverse lookup would not occur.

Independent claim 14 is allowable for similar reasons as claim 1.

Dependent claims 2-7, 9, 11-13, 15-20, 22, and 24-27 depend from claims 1 and 14, and are allowable for the same reasons as the corresponding base claim. Further limitations patentably distinguish from the cited references.

Claims 3 and 16 recite determining the display coordinates of interest. The Examiner cites to col. 8, lines 4-9 of Halmann, et al. However, col. 8, lines 4-9 show scan or polar coordinate data, not display coordinates. *The Examiner points out that scan converted data are in effect display coordinates. However, Halmann, et al. do not determine particular coordinates of interest, but instead just scan convert all the available polar coordinate data to Cartesian coordinate data.* Claim 3 also recites identifying the ultrasound data by inputting the display coordinates into the look-up table. The cited portions of Halmann, et al. do not disclose use of the table in this way. *The Examiner alleges that input of coordinates is part of the scan conversion process. However, polar coordinate data may be scan converted to Cartesian coordinate data without input of the Cartesian coordinates.*

Claims 5 and 18 recite the display coordinates of interest input to the look-up table being coordinates for a plurality of rays through the volume. Halmann, et al. disclose a raycasting/volume rendering module 201, but this module 201 is not shown to work with the tables of the separate scan conversion module 207.

The Examiner alleges that the coordinates of rays are examples of the input of display coordinates. However, Halmann, et al., like most, treat rendering and scan conversion separately. Typically, scan conversion is performed for two-dimensional imaging. For three-dimensional rendering, the data is interpolated to a three-dimensional grid, not scan converted. Halmann, et al. provide no indication of deviation from this norm, but instead imply use of the norm by providing independent modules for raycasting/volume rendering and scan conversion.

Claim 11 recites a graphics processing unit (GPU). A GPU is a term of art for hardware designed specifically for graphics processing. The CPUs of Halmann, et al. are not GPUs merely because they process graphics. A person of ordinary skill in the art would understand that a CPU is not a GPU. Given the versatile processing taught by Halmann, et al. (see abstract), a person of ordinary skill in the art would use a CPU, not a GPU.

The Examiner alleges that "GPU" must be broadly interpreted as a processor that processes graphics since the specification does not provide a more narrow meaning. However, those of skill in the art would understand GPU to have a more narrow meaning. As a term of art, GPU means more than just a processor that processes graphics. As a term

of art, GPU is known to be more narrow. People of ordinary skill in the art would recognize that the processor of Halmann, et al. is not a GPU. The Examiner cannot provide a broader meaning to a term of art, effectively creating his own definition contrary to accepted understanding.

Claim 15 recites outputting Polar coordinates interpolated from the look-up table. Halmann, et al. interpolate ultrasound data, but do not disclose outputting interpolated Polar coordinates from the table.

The Examiner points to the use of polar coordinates in the lookup table and that the coordinates are interpolated. However, this merely indicates starting with polar coordinates to derive display coordinates, not deriving (outputting) polar coordinates interpolated from the look-up table. Halmann, et al. interpolate display coordinate data from input polar coordinate data.

Claim 26 recites generating a two-dimensional look-up table with acquisition format coordinates for each coordinate of a Cartesian volume. Halmann, et al. treat volume rendering separately from scan conversion. There is no disclosure of a LUT for coordinates of a Cartesian volume.

The Examiner alleges that the column 7 display process would be used for a constructed 3D volume. However, column 5 notes that the rendering module generates an image (col. 5, lines 34-40). The scan conversion of column 7 is not needed and would not be performed since rendering and raycasting automatically determine display format data without the scan conversion of column 7.

Claim 2 recites values of the look-up table being Polar coordinates where the look-up table is indexed by integer Cartesian coordinates. Halmann, et al. do not disclose coordinate values in the look-up table, and do not disclose Polar coordinates as the values of the look-up table indexed by Cartesian coordinates. Zar discloses bilinear interpolation of ultrasound data, not a look-up table of coordinates.

The Examiner references the claim 1 discussion. As discussed for claim 1, Halmann, et al. do not provide these limitations.

Claim 4 recites the processor operable to determine a plane through a volume as the display coordinates where the display coordinates are input to the look-up table. Hossack, et

al. show arbitrary plane display for a volume, but do not use the coordinates of the plane as an input to the look-up table. Halmann, et al. treat volume rendering and scan conversion separately, so do not use coordinates of a plane in a volume as input to the scan conversion table. Claim 17 is allowable for similar reasons.

The Examiner references the claim 1 discussion. As discussed for claim 1, Halmann, et al. do not provide these limitations.

Claims 6 and 19 are allowable for the same reasons as claim 5. Claims 6 and 19 are also allowable because a person of ordinary skill in the art would not have used the cited rendering of Okerlund, et al. with Halmann, et al. The cited section for alpha blending of Okerlund, et al. teach a hardware based RGBA approach (col. 7, lines 4-19). Alpha blending is provided using hardware acceleration. However, Halmann, et al. desire versatility so use programmable CPUs to avoid hardware specialization (col. 2, lines 42-52). A person of ordinary skill in the art would not have used the hardware acceleration based alpha blending of Okerlund, et al. with the general programming approach of Halmann, et al.

The Examiner alleges that no reason was given why the programmable CPUs of Halmann, et al. would not be compatible with the RGBA of Okerlund, and notes the more rapid generation of images in Okerlund. However, the more rapid generation is because Okerlund provides a hardware based solution. The programmable CPUs would not provide the same speed since they are general processors, not hardware based renderers. The RGBA is not compatible with the CPUs of Halmann, et al. in the since that porting RGBA to software would not provide the advantages the Examiner relies on as a reason to even use Okerlund teachings with Halmann, et al.

Claims 9 and 22 recite an additional look-up table corresponding to conversion from the display format to the acquisition format across multiple acquisition planes. Swerdloff discloses multiple tables, but not a table for conversion across multiple planes.

The Examiner notes that a change in relationship causes another lookup table. However, this lookup table would be for the new plane, not across planes.

Claim 12 recites a flag, and an integer sum. As noted in the specification, an integer sum allows indication of spatial relationship relative to other table entries. Halmann, et al. do not suggest any format for the look-up table, and certainly do not disclose an integer sum,

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a flag or fixed-point values. These values are chosen to allow table based identification of data rather than scan conversion of the data. Selective scan conversion of only the samples that contribute to the rendering result without having to scan convert occluded data is provided by the recited table variables. A person of ordinary skill in the art would not have provided the listed classes as a mere design choice.

The Examiner alleges the flag and integer sum as not particularly helpful and being a design choice. Paragraphs 33, 38, and 50 show the specific use in the recited circumstance (inverse lookup). This use is not applicable to typical scan conversion, so would not be a design choice.

Claims 13 and 25 are allowable for similar reasons as claim 12. Claim 13 also recites using the flag of the look-up table for location outside of the scanned region. Halmann, et al. desire to scan convert all of the data (col. 9, lines 4-13).

The Examiner alleges that a flag when the end of the data is reached would be obvious. However, such as flag is used to show no more data, not used to indicate location, or location outside a scanned region.

Consideration of new dependent claims 28 and 29 is requested.

CONCLUSION

Applicants respectfully submit that all of the pending claims are in condition for allowance and seeks early allowance thereof. If for any reason, the Examiner is unable to allow the application but believes that an interview would be helpful to resolve any issues, he is respectfully requested to call Craig Summerfield at (312) 321-4726.

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